TRIBHUVAN UNIVERSITY

Bachelors of Science in Computer Science and Information Technology (BSc. CSIT)

Institute of Science and Technology

Model Question Paper

Course Title: Numerical Method **Full marks:** 60

Course No.: CSC 204 **Pass Marks:** 24

Time: 3 hrs.

Candidates are required to give their answer in their own words as for as practicable.

The figures in the margin indicate the full marks.

Attempt all questions.

1. Derive the formula for Secant method using an illustrative figure. Find a real root of following equation using secant method correct up to two decimal places.

$\sin x - 2x + 1 = 0$ (3+5)

OR

Derive the equation of Newton Raphson's method, and find a real root of $x^3 + x^2 - 3x - 3 = 0$ in the interval [1,2] correct up to three significant digits. (3+5)

2. Derive the equation for Lagrange's interpolation polynomial and find the value of f(x) at x=0 for following function.

x	-1	-2	2	4
F(x)	-1	-9	11	69

(4+4)

3. a) Evaluate $\int_0^1 e^{-x}\,dx$ using Gaussian integration three point formula. (4)

b) Calculate the integral value of following function from x=0 to x=1.0 using Simpson's 1/3 rule.

x	0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6
f(x)	0	0.24	0.55	0.92	1.63	1.84	2.37	2.95	3.56

(4)

4. What is pivoting? Why is it necessary? Solve the following system of linear equation using Gauss-Jordan method (use partial pivoting if necessary) or Gauss-Seidel method. (2+6)

$$x_2 + 3x_3 + 2x_4 = 19$$
$$2x_1 - 2x_2 - x_3 - x_4 = -9$$
$$3x_2 + 2x_3 + 2x_4 = 20$$
$$x_1 + 4x_2 + 2x_4 = 17$$

5. Solve the following differential equation $\frac{dy}{dx} = 3x + \frac{y}{2}$, with $y(0) = 1$ for $0 \le x \le 0.2$ using

a) Euler's method

b) Heun's method

Also compare the results. (3+4+1)

6. Derive a difference equation to represent a Poisson's equation. Solve the Poisson's equation $\nabla^2 f = 2x^2y^2$ over the square domain $0 \leq x \leq 3$ and $0 \leq y \leq 3$ with $f = 0$ on the boundary and $h = 1$.

(3+5)

7. Write an algorithm and program to solve system of linear equation using Gauss elimination method. (5+7)

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2066

Bachelor Level/Second Year/Third Semester/Science — Full Marks: 60

Computer Science and Information Technology (CSC. 204) — Pass Marks: 24

(Numerical Method) — Time: 3 hours.

Candidates are required to give their answers in their own words as for as practicable.

The figures in the margin indicate full marks.

Attempt all questions:

1. Define the fixed point iteration method. Given the function f(x) =x^2-2x-3x=0, rearrange the function in such a way that the iteration method converses to its roots. (2+3+3)
2. What do you mean by interpolation problem? Define divided difference table and construct the table from the following data set

x_i	3.2	2.7	1.0	4.8	5.6
f_i	22.0	17.8	14.2	38.3	51.7

(2+2+4)

OR

Find the least-squares line that fits the following data.

x	1	2	3	4	5	6
y	5.04	8.12	10.64	13.18	16.20	20.04

What do you mean by linear least-squares approximation?

3. Derive a composite formula of the trapezoidal rule with its geometrical figure. Evaluate $\int_2^1 e - x^2\, dx$ using this rule with n=5, up to 6 decimal places. (4+4)
4. Solve the following system of algebraic linear equations using Jacobi or Gauss-Seidel iterative method.

$$6x_1 - 2x_2 + x_3 = 11$$
$$-2x_1 + 7x_2 + 2x_3 = 5$$
$$x_1 + 7x_2 - 5x_3 = -1$$

(8)

5. Write an algorithm and computer program to fit a curve $y = ax^2 + bx + c$ for given sets of (x_i, y_i, g, 0=1, ….., x) values by least square method. (4+8)
6. Derive a difference equation to represent a Poisson's equation. Solve the Poisson's equation $\nabla^2 f = 2x^2y^2$ over the square to main $0 \le x \le 3, 0 \le y \le 3$ with f=0 on the boundary and h=1. (3+5)
7. Define ordinary differential equation of the first order. What do you mean by initial value problem? Find by Taylor's series method, the values of y at x=0.1 and x=0.2 to find places of decimals from

$$\frac{dy}{dx} = x^2y - 1 \quad ; y(0) = 0$$

(2+6)

Tribhuvan University

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2067

Bachelor Level/Second Year/Third Semester/Science	Full Marks: 60
Computer Science and Information Technology (CSC 204)	Pass Marks: 24
(Numerical Methods)	Time: 3 hours.

Candidates are required to give their answers in their own words as for as practicable.
The figures in the margin indicate full marks.
Attempt all questions:

1. Discuss methods of Half-Interval and Newton's formula or solving the nonlinear equation f(x)=0. Illustrate the methods by figures and compare them stating their advantage and disadvantages. (8)
2. Derive the equation for Lagrange's interpolating polynomial and find the value of f(x) at x=1 for the following:

X	-1	-2	2	4
f(x)	-1	-9	11	69

(4+4)

3. Write Newton-Cotes integration formulas in basic form for x=1, 2, 3 and give their composite rules. Evaluate $\int_{0.2}^{1.5} e^{-x^2}\,dx$ using the Gaussian integration three point formula.
4. Solve the following algebraic system of linear equations by Gauss-Jordan algorithm.

$$\begin{bmatrix} 0 & 2 & 0 & 1 \\ 2 & 2 & 3 & 2 \\ 4 & -3 & 0 & 1 \\ 6 & 1 & -6 & -5 \end{bmatrix} \begin{bmatrix} x^1 \\ x^2 \\ x^3 \\ x^4 \end{bmatrix} = \begin{bmatrix} 0 \\ -2 \\ -7 \\ 6 \end{bmatrix}$$ (8)

5. Write an algorithm and program to solve system of linear equations using Gauss-Seidel iterative method. (4+8)
6. Explain the Picard's proves of successive approximations. Obtain a solution upto the fifth approximation of the equation

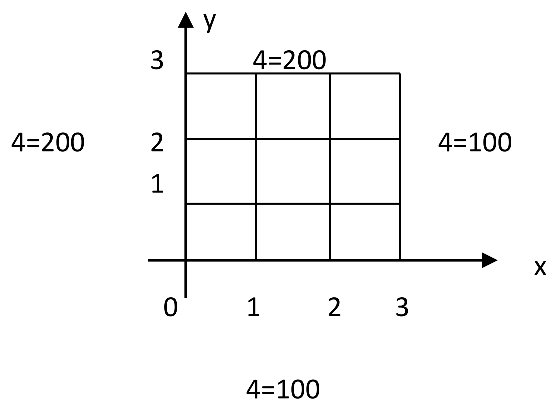
   $\frac{dy}{dx}$ = $y + x$ such that $y = 1$ when $x = 0$

   using Picard's process of successive approximations.

7. Define a difference equation to represent a Laplace's equation. Solve the following Laplace equation.

   $\frac{\partial^2 y}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}$ = 0 within $0 \le x \le 3, 0 \le y \le 3.$

   For the rectangular plate given as:



(3+5)

OR

Derive a difference equation to represent a Poison’s equation. Solve the Poison’s equation

$$\nabla^2 f = 2x^2y^2$$

over the square domain $0 \leq x \leq 3, 0 \leq y \leq 3$, with f=0 on the boundary and h=1. (3+5)